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STUDENT REPORT

ALTERNATIVE MAINTENANCE ORGANIZATION STRUCTURES FOR OPERATIONAL WINGS

MAJOR STANLEY L. JUSTICE 88-1410

"insights into tomorrow"

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Maintenance organizations have evolved over time because of the environment, technology, size, and mission. This study addresses the basic question of how today's maintenance organizations support the Air Force's new logistics concept of operations. First, background research examines basic management theory, the development of maintenance organizations, and today's overall logistics concept. Then, centralized maintenance used in Military Airlift Command and decentralized maintenance used by Strategic Air Command and the Tactical Air Forces are described. The background and descriptions provide a basis to identify potential problems meeting the overall logistics concept of operations.

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Submitted to the faculty in partial fulfillment of
requirements for graduation.

AIR COMMAND AND STAFF COLLEGE
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PREFACE

Maintenance organizations have evolved over time because of the environment, technology, size, and mission. This study addresses the basic question of how today's maintenance organizations support the Air Force's new logistics concept of operations. First, background research examines basic management theory, the historical development of Air Force maintenance organizations, and today's overall logistics concept of operations. Then, centralized maintenance used by Military Airlift Command (MAC) and decentralized maintenance as exemplified by the Tactical Air Forces (TAF) and Strategic Air Command (SAC) are described. The background and descriptions provide a basis to identify potential impacts the organizational structure of these organizations may have in supporting the new logistics concept of operations.

This project also provided an opportunity to familiarize myself with current maintenance organizations at the operational wing level. Having been in education and career broadening assignments for the past four years, this research was welcome preparation for return to the flightline. Without help and support this project would have been much more difficult. I wish to express my appreciation to Lt Col David M. Rigsbee of the Air Force Logistics Management Center for providing vital information to get this project off the ground. Also, Major Charles F. Holsen for his guidance and editorial assistance as my academic advisor. Finally, a special thanks to my wife, Jo, for her patience and encouragement during this project.

ABOUT THE AUTHOR

Major Stanley L. Justice [redacted]. He graduated from Mt. Sterling High School in Mt. Sterling, Kentucky in 1963. He enlisted in the Air Force in April 1966 and served as an Avionics Technician. Major Justice received a Bachelor of Science in Business Administration through the Airman Education and Commissioning Program at the University of Missouri in August 1974. He was commissioned upon completion of Officer Training School on 19 November 1974. He completed the Avionics Maintenance Officer Course in May 1975. He then served in the 82d Field Maintenance and 82d Organizational Maintenance Squadrons at Williams AFB, Arizona. During this assignment, Major Justice completed Squadron Officer School in residence and earned a Master's Degree in Management from the University of Northern Colorado. His next assignment was to the 8th Aircraft Generation Squadron, Kunsan AB, Republic of Korea. Following that assignment, he became the Commander of the 2955th Combat Logistics Support Squadron, Robins AFB, Georgia. His next assignment was to the Headquarters Air Force Logistics Command, Office of the Inspector General, as a maintenance inspector until entering the School of Systems and Logistics, Air Force Institute of Technology, in May 1984. Major Justice graduated with a Master's Degree in Acquisition Logistics in September 1985 and was transferred to Headquarters Air Force Militaty Personnel Center at Randolph AFB, Texas. Here he worked within the Colonels' Group as the Logistics Assignment Officer until his current assignment to Air Command and Staff College. He is married to the former Billie Jo [redacted] and has four children, Stanley Jr, Kellie, Kevin, and Sarah.

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EXECUTIVE SUMMARY

REPORT NUMBER 88-1410

AUTHOR(S) MAJOR STANLEY L. JUSTICE, USAF

TITLE ALTERNATIVE MAINTENANCE ORGANIZATION STRUCTURES FOR OPERATIONAL WINGS

I. Purpose. This study seeks to determine if current maintenance organization structures adequately support the new Air Force logistics concept of operations. By evaluating maintenance organization structures, potential impacts on support to the overall logistics concept of operations can be identified.

II. Problem. Maintenance organizations have evolved over the years to meet specific mission requirements in a variety of combat and peacetime environments. Centralized and decentralized structural characteristics influence the degree of flexibility and responsiveness within an organization. Further, the management philosophy inherent with different structures can have a direct impact on the self-sufficiency of the maintenance organization. For the first time in recent years, a logistics concept of operations focuses all logistics disciplines on the harsh combat environment. If maintenance organization structures are not effective, our ability to survive and win may be in jeopardy.

III. Data. First, management theory provides a framework for understanding classical and behavioral organizational design approaches. The classical supports the bureaucratic system while the behavioral approach advocates a more participatory system.

Centralization and decentralization parallel these approaches respectively. Second, history shows that centralization worked to focus maintenance effort and improve efficiency during and after World War II. Decentralized organizations promoted flexibility at the organizational maintenance level in Korea while centralized intermediate level maintenance provided efficient support from sanctuaries in Japan. During Vietnam the attempt to decentralize under the squadron maintenance organization was ill conceived and ended in a return to the centralized concept. Today we see examples of both a centralized and decentralized organizations which are described in detail in the study. Third. the new concept of operations provides the benchmark by which logistics support can be evaluated.

IV. <u>Conclusions</u>. The centralized and decentralized maintenance organizations of today can meet the objectives of the logistics concept of operations. Each organization brings with it unique capabilities and potential shortcomings. Centralized maintenance is efficient and and self-sufficient with its organic intermediate level capability, but vulnerable support equipment and specialization could reduce flexibility. The decentralized organizations are lean, deployable, and flexible; however they are potentially vulnerable to disruption of lines of communication which sustain spare parts support. These positive and negative aspects need to be tested in peacetime to fully integrate the maintenance organization into the logistics concept of operations.

V. <u>Recommendations</u>. First, increase exercise realism to test the ability of maintenance organizations to sustain combat operations in an austere and hostile environment. Second, develop comprehensive simulation models to evaluate the effects of an evermore demanding threat. Finally, continue to sponsor and coordinate logistics research to find and resolve logistics problems.

CHAPTER ONE

INTRODUCTION

Thesis

The logistics dimension of war has throughout the history of armed conflict directly affected its prosecution and outcome.(4:1) Rear Admiral Henry E. Eccles stated, "In all war situations, the actions and decisions of command, whatever the level, are based on a blend of strategical, logistical, and tactical plans." (4:1) Maintenance is a major function of the logistics element directly involved in the application of air power in the prosecution of modern warfare. If this critical function is not organized, trained, and equipped to support tactical and strategic operations in the hostile environment of war, our ability to effectively engage an adversary and win will be seriously compromised.

The structural orientation of maintenance organizations can have a significant impact on the way maintenance responds to the demands of combat operations. The concept of centralization/decentralization of authority lies at the heart of Air Force maintenance organization design. Where along the continuum between centralized control and decentralized control an organization operates is dependent on many factors. An understanding of how organization size, technology, environment, and tradition shape the way major commands organize their maintenance functions will enable leaders to better meet the logistics challenges of the future.

Purpose

To provide a better understanding of how organizational design impacts the way maintenance meets the requirements outlined in the Air Force logistics concept of operations, this research will focus on practice and theory. First, this study will trace the development of maintenance organizations in the Air Force since becoming a separate service and shows the evolution of maintenance emphasis from centralization to decentralization. Second, the project investigates management theory to provide insight into the possible advantages and disadvantages encountered as organizations move along the centralization/decentralization spectrum. Third, this study uses the current logistics concept of operations as a benchmark to assess potential shortcomings in maintenance. Meeting these objectives required selection of a basic methodology.

Methodology

For this research effort a literature review was selected as the most expedient method. Current and historical Air Force documents are the basis for describing maintenance organizations, past and present. Management texts, articles, and research reports provide the essential tools to analyze the impact of organizational design considerations.

Overview

The first part of this project provides the background in management theory, shows examples of Air Force maintenance practice from WW-II to the present, and outlines significant aspects of the current logistics concept of operations. This background leads to a description of centralized maintenance organization exempli- fied by Military Airlift Command (MAC). Then the decentralized systems employed in the Tactical Air Forces (TAF) and Strategic Air Command are described. The final chapter concludes with an analysis of the role of centralization/decentralization and the potential impact of current organizational design on supporting today's logistics concept of operations.

CHAPTER TWO

BACKGROUND

Organizing is one of the functions of management taught in government, industry, and the military. From experience various theories evolved as to how organizations should be designed to meet their missions. Classical design theory is illustrated in the development of Air Force maintenance organizations. Investigating the major tenets of classical design theory helps one understand this development. Behavioral science challenged classical theory and some Air Force major commands shifted organizational emphasis. The organizational concept of centralization seems to have shifted most. This chapter focuses on management theory, Air Force application, and the current logistics concept of operations. These theoretical, historical, and environmental perspectives provide a benchmark to evaluate current organizations

MANAGEMENT THEORY

Classical design theory has its roots in scientific management, classical organization theory, and bureaucratic theory. (2:61) The behavioral approach developed with a strong influence from the social sciences. More recently a contingency (situational) approach has integrated the approaches to organizational design. (6:295)

Classical Design Theory

This approach to organizational design evolved around the turn of the century. Three major areas combined to form the classical design theory.

Scientific Management. Fredrick W. Taylor was a leader in developing the concept of scientific management. His research focused on work done at the lowest level of the organization. (2:61) Scientific management produced concepts emphasizing specialization, rules, training, planning, standards, and wage incentives. Taylor and others developed systematic methods in order to increase productivity and efficiency of the work force. These concepts and methods were not directly applied to the broader problem of organization design. (2:61)

Classical Organization Theory. Scientific management lacked the view of the organization as a whole. The French engineer

Henri Fayol provided a theoretical basis for overall management of organizations. He distinguished between operating and managerial activities. His five functions of management: planning, organizing, commanding, coordinating, and controlling, are basic to any management training today. Additionally, Fayol proposed fourteen principles of management to guide managers in resolving problems. (6:51-53) The authors of Organizations: Structure, Process, Behavior grouped five of Fayol's principles which impact structural considerations. They are:

> 1. The principle of division of work. According to Fayol the division of work, or specialization of labor, is a natural means to produce more and better work with the same effort...
> 2. The principle of unity of direction. The jobs which result from implementing the division of work principle must be regrouped if there is to be coordinated effort...
> 3. The principle of centralization. The process of increasing and decreasing the authority of managers is termed centralization-decentralization...
> 4. The principle of authority and responsibility. This principle states that there must be some relationship between the responsibility of a manager and the authority that he exercises; the desired relationship is equality between the two...
> 5. The scalar chain principle. The natural result of implementation of the preceding four principles is the creation of a graded chain of superiors from the "ultimate authority to the lowest ranks."...(2:70-71)

Classical organization theory stressed application of these principles in planning the organization.

Bureaucratic Theory. The German sociologist Max Weber wrote about the dominant classical organizational design, bureaucracy. Weber outlined the significant characteristics of a bureaucracy which he believed was the "one best way" to structure all types of organizations. (6:289) Peter M. Blau in On The Nature Of Organizations selected the following six as most important:

> 1. Organizational tasks are distributed among various positions as official duties. Implied is a clear cut division of labor making possible a high degree of specialization...
> 2. The positions or offices are organized into a hierarchical authority structure...
> 3. A formally established system of rules and regulations governs official decisions and actions...
> 4. There is a specialized staff whose task is to maintain the organization and, in particular, the lines of communication in it...

5. Officials are expected to assume an impersonal orientation in their contacts with clients and with other officials...
6. Employment by the organization constitutes a career for officials... Employment is based on technical qualifications... (1:30-31)

Clearly, the elements of scientific management, classical organization theory, and bureaucratic theory, are intertwined. These theories, which shaped classical design theory, have come under criticism from those who favor a more behavioral orientation. Specific criticisms include excessive red tape, inflexibility, dominance of authority, and position protection. This led researchers to investigate other approaches. At the opposite end of the spectrum from classical design theory is the behavioral approach.

Behavioral Approach

Rensis Likert and Warren Bennis developed alternative means to address organizational design considerations. They believed the behavioral approach was the best way.

System 4. Likert believed the classical approach was not capable of responding to environmental changes. The alternative he called System 4 was based on eight process dimensions. Andrew Szilagyi, Jr's book, Management And Performance, describes these processes, outlined here. The leadership process focuses on confidence and trust between superior and subordinate. The motivational process emphasizes participation. The communication process permits free flow throughout the organization. The interaction process among superiors and subordinates involves goals, methods, and activities. The decision process is decentralized. The goal setting process encourages group participation in setting high, realistic goals. The control process emphasizes self-control and problem solving throughout the organization. Performance goals are high and actively sought by superiors. (6: 294)

Szaligyi also shows how Likert contrasts a negative for each processes in classical approach. The leadership process is void of confidence and trust. Motivation is based on physical, security, and economic needs through the use of sanctions and fear. Communications flows downward and gets distorted and inaccurate. Interaction is closed and restricted. The decision process occurs only at the top of the organization and is relatively centralized. Goal setting at the top of the organization discourages participation. The control process is centralized and emphasizes fixing blame for mistakes. Performance goals are low and passively sought by managers. (6:294) This negative view of classical theory was shared by Warren Bennis.

Bennis' Prediction. Bennis forecasts the demise of bureaucracy because of the inability to manage tension, frustration, and conflict between individual and organizational goals. (6:293) Also, the rigid structure of bureaucracy will not be flexible enough to adapt to rapid changes. Both Likert and Bennis emphasize a participatory style of management organization.

Classical theory and the behavioral approach are extremes which claim to be the one best way. Between these extremes lies the compromise which integrates the positive aspects of classical theory with the behavioral approach. One aspect which continues to receive significant attention in Air Force maintenance organizations is centralization/decentralization.

Centralization/Decentralization

Szilagyi defines centralization, "as that situation in which a minimal number of job activities and a minimal amount of authority are delegated to subordinates." (6:715)

> Van de Ven and Ferry (1980) define centralization as "the locus of decision making authority within an organization. When most decisions are made hierarchically, an organization is considered centralized; a decentralized unit generally implies that the major source of decision making has been delegated by line managers to subordinate personnel." (3:115)

The central theme in both definitions is the level at which decisions are made. The degree to which an organization chooses to centralize decision authority is dependent on size, technology, and the environment. Air Force maintenance organizations have employed varying degrees of centralization in organizational design through the years.

AIR FORCE MAINTENANCE ORGANIZATION DEVELOPMENT

World War II

European. Theater maintenance was organized into four echelons. The first two covered routine servicing and repairs and preventive maintenance limited by organizational equipment. The maintenance personnel assigned to operational squadrons performed these two first levels with crew chiefs responsible for their aircraft. Level three, similar to today's intermediate level, repaired components removed from the aircraft. Personnel at this level were assigned to sub-depots under Air Service Command. Depot maintenance, level four, was performed at Air Service Command's main depots. This arrangement created problems in two ways. First, at the lower level one organization could be working round the clock while another unit at the same base was not. Second, third level maintenance was not always working with the same priorities as the operational unit. (4:100)

Pacific. Prior to 1944, maintenance in the Pacific followed the same concept used in Europe. However in June 1944, General Arnold directed the reorganization of maintenance in XX Bomber Command. First through third echelon maintenance resources were consolidated. Functional shops and centralized control were established with responsibility to support all assigned aircraft. "Although the reorganization received resistance from various units, General Lemay gave strong support." (4:101) "Major General Curtis Lemay improved aircraft in-commission rates by introducing the centralized maintenance concept that became SAC's standard." (4:104)

Another innovation in aircraft maintenance was introduced by Brigadier General William H. Turner in the China-India campaign flying over the Hump. General Turner increased reliability and decreased maintenance time with his Production Line Maintenance. Aircraft were towed through a series of maintenance stations manned by specially trained crews tasked to perform specific operations. (4:128) This system complimented the centralized organization concept.

Korean War

Stateside. The centralized maintenance concept was not adopted Air Force wide following the war. Brigadier General James R. McCarthy described his first experience in maintenance at Duke Field, Eglin AFB, Florida in 1952.

> There was no job control element as we know it today. Each afternoon the squadron maintenance officer would review the status of the aircraft and, with the advice of his officers and senior NCOs, would determine which aircraft would fly assigned missions the next day. (8:49)

Korea. At the outset several problems hampered maintenance. First, maintenance organizations were not standardized. Second, the fluid nature of the front and operational limitations required fighter and light/medium bomber wings to forward deploy and disperse frequently. Third, intermediate level maintenance had difficulty moving and setting up support equipment. Finally, the environment was extremely harsh and facilities very limited.

Fifth Air Force attempted to resolve these problems by setting up an Intermediate Maintenance Support Unit in Japan. Aircraft were flown there for preventive maintenance and repairs above the organizational level. "The lack of centralized scheduling system closely coordinated with operating units resulted in backlogs of as many as 25 aircraft awaiting repair." (5:246)

The problem was solved when Rear Echelon Maintenance Combined Operations (REMCO) was established. By combining the intermediate level maintenance functions of two wings at safe rear area bases in Japan, the operating wings became more flexible. Using Air Force Production Control as guidance, REMCO established a centralized control structure with a Production Control Chief, Work Order Planning, Material Control, Scheduling, and Analysis sections. Thus, REMCO, a form of centralized intermediate level maintenance, proved to be an effective means to solve the problems encountered in Korea.

Intervening Years

Between the end of the Korean War and the Vietnam War, technical advances in weapon systems led to increased specialization and a formally centralized maintenance concept. Air Force Manual (AFM) 66-1, Maintenance Management Policy, was published in September 1956 as a command option, but later became mandatory Air Force wide in 1958. (4:150-151) This was the first standardized maintenance organization system. It established a chief of maintenance and staff function responsible for centralized control of all maintenance. AFM 66-1 provided for functional maintenance squadrons to perform maintenance. This system professed centralized control and decentralized execution; however, from an organizational design perspective, the system exhibited many classical organizational theory characteristics. For example, bureaucratic hierarchy, job specialization, centralized control, and strict rules were common traits of the system.

Vietnam

Early in the war Pacific Air Forces (PACAF) tried a new concept in Southeast Asia which was also being implemented in Tactical Air Command (TAC). Organizational maintenance personnel and munitions load crews were assigned to the flying squadrons. While the flightline maintenance personnel were assigned to the flying squadron, the maintenance officer still worked for the chief of maintenance. Further, the chief of maintenance staff planned, scheduled, and controlled the maintenance personnel. The conflicts introduced by this new conceptled PACAF to return to the AFM 66-1 structure by the end of 1966. (4:160) TAC went back to AFM 66-1 after the war.

Post Vietnam

After Vietnam, maintenance organizations were all basically AFM 66-1 organizations. Two factors caused TAC to reevaluate the effectiveness of AFM 66-1 for tactical air forces. First, TAC units deploy as squadrons, but AFM 66-1 was oriented to a total wing concept. Second, the 1973 Arab/Israeli War showed that by cross utilizing personnel sortie rates could be significantly increased. (7:46) TAC undertook a new concept of maintenance aimed at more effective support of the operational mission and increased readiness for deployment contingencies. The new organizational structure was called Production Oriented Maintenance Organization (POMO) and was initially tested in 1975. (7:46) Three new squadrons were developed; Aircraft Generation Squadron (AGS), Component Repair Squadron (CRS), and Equipment Maintenance Squadron (EMS). (4:182) The squadrons perform two functions: on-equipment maintenance which are actions to service or return the aircraft to operational ready status and off-equipment maintenance which returns components removed from the aircraft to service. AGS is the primary on-equipment squadron. While the overall maintenance organization falls under the Deputy Commander for Maintenance (DCM), the controlling staff function, Job Control, took on a monitoring and coordinating role. Production decision making was delegated down to the squadron level. This concept achieved a much greater degree of decentralization.

Over the years maintenance organizations have changed significantly. Whether the change was to greater or lesser centralization appears more a function of the operational envirionment than application of abstract theories. Toward the end of WW-II, centralized maintenance was adopted to overcome inefficient application of maintenance resources in support of the air war in the Pacific. REMCO was used in Korea to offset vulnerability of intermediate maintenance in forward areas. Squadron maintenance was tried in Vietnam where there was no threat from the air. Basic organizational conflict caused this system to be abandoned. After Vietnam, TAC still needed a system tailored to its deployment concept. The Middle East War of 1973 showed the volatile nature of modern conflict and the need to be more flexible. These historical developments teach that to be effective in today's environment the maintenance organization must be structured as an integral part of the larger logistics concept of operations.

LOGISTICS CONCEPT OF OPERATIONS

During 1987, Air Staff and MAJCOM logistics staffs developed a logistics concept of operations which provided an assessment of the combat environment, identified deficiencies, and outlined an overall logistics concept. The concept focuses on integrating logistics functions with operational requirements. This section summarizes the major environmental aspects and the tenets of the concept. Additional environmental insight was drawn from "Project RELOOK."

The Environment

The logistics concept of operations describes the environment in four broad areas.

- High levels of combat attrition for platforms, support equipment and other combat inventories. Attrition levels will vary dependent upon the level of conflict and the theater of operation.
- Vulnerability of fixed sites due to accuracy and lethality of weapons as well as sabotage. Each theater needs to treat the vulnerability of assets based on the threat.
- High levels of consumption (munitions, POL, spare parts, consumables) by our weapons platforms can be anticipated, but consumption is different among various theaters.
- Industrial production will require months to gear up to demand. (17:2)

The intensity of the threat as shown is dependent upon the theater. Project RELOOK Phase IV Report (Logistics Concept) described the European theater as follows:

> The airfield environment in a central European war will be characterized by heavy and sporadic attacks, with severe damage to runways, taxiways, unhardened facilities, communication networks, and utility systems. Communication and transfer of logistical information will, at unpredictable times, be virtually impossible due to a combination of attack damage and saturation. Due to battle damage, sabotage, and infiltration by trained agents, sympathizers, and operational maneuver groups, physical lines of communication (road, rail, externally supplied utilities, and possibly airlift) cannot be counted on to provide uninterrupted sustainment. Air bases will be attacked in the opening hours of conflict by air and should expect ground attack by small forces within days and regular units within weeks. (9:1)

These examples depict an environment much more hostile to the maintenance organization than that experienced in previous conflicts. It was in this environmental context that the logistics concept of operations was developed.

Concept

The logistics concept of operations emphasizes three major themes, "maximizing unit self-sufficiency, bringing depot capability to bear and applying theater assets to fill shortages." (17:5) To meet these requirements a system must be based on a posture of readiness and flexibility. That posture is achieved by the following:

> a. Recognizing wartime, and peacetime, uncertainties...
> b. Making "best use" of (allocating) available logistics resources (worldwide) in a manner that reflects operational priorities for each unit through a flexible and responsive support system...

c. Recognizing the need for unit self-sufficiency especially during finite periods when external support may be disrupted or otherwise unavailable or unresponsive...
d. Continuing reevaluation of the cost/effectiveness of all aspects of the concept of operations to assure it continues to maximize combat capability over time.
e. Approximating (and aggressively testing) the wartime concepts in peace time.
f. Applying creativity, innovation and new technologies, and information systems to continual improvements in logistics support. (17:5-6)

Further, the concept has eight support elements:

1. Mutual Support. Mutual support strengthens the individual fighting unit by drawing upon theater resources to fill shortfalls...
2. Depot Support. Depot support focuses first on maintaining unit readiness...
3. Forward Support. Forward support consists of "warm" facilities located within the theater.
4. Joint Operations/Allied Support. Requires the theaters to work logistics support with other services and host nations...
5. Intertheater Transportation. Intertheater transportation (air and sea) provides a frequency of delivery resulting in a continuous flow of resources to the theater...
6. Intratheater Transportation. Intratheater transportation, land, sea, and air will be used for unit resupply or redistribution of resources to other theater locations...
7. Command and Control. Command and control is the steel thread which must pass through and connect all logistics resources and activities...
8. Mobility. Mobility of our combat forces is critical to the success of any contingency operation. (17:7-8)

While this concept looks at the total logistics system, it provides a framework to assess specific aspects of maintenance organizations. Flexibility, responsiveness, creativity, mobility, innovation, and self-sufficiency are characteristics that maintenance organizations need to effectively support the logistics concept of operations. These concepts along with the theoretical, historical, and environmental background set the stage as the major centralized and decentralized maintenance organizations are described in the following chapters.

CHAPTER 3

CENTRALIZED MAINTENANCE

Military Airlift Command (MAC)

Maintenance Organization

MAC retains much of the centralized maintenance system which was previously defined in AFM 66-1, Maintenance Management Policy. MAC Regulation 66-1, Maintenance Management Policy, now specifies the organization structure and responsibilities assigned to each activity in the maintenance organization. The majority of MAC maintenance units follow the centralized system. The overall maintenance organization is made up of the Deputy Commander for Maintenance (DCM) with his/her staff supported by three squadrons which provide the manpower and equipment to perform maintenance. (10:7)

Avionics Maintenance. The Avionics Maintenance Squadron (AMS) is the primary source for both on-equipment and off-equipment maintenance capability for electronic systems used on assigned aircraft. This function may be designated a branch in some Small Maintenance Organizations (SMO) when unit size dictates. Additionally, if unit size or weapon system supported do not necessitate a separate squadron, the functional avionics shop specialists may be incorporated into the next major organizational unit, the Field Maintenance Squadron (FMS).

Field Maintenance. FMS does off-equipment maintenance within the capability of specialists, equipment, and facilities. It also does on-equipment maintenance beyond the capability of other assigned maintenance activities and on FMS assigned equipment, such as test equipment and maintenance stands. There are normally four major functional elements within FMS. First, Fabrication is responsible for inspection, repair, or local manufacture of aircraft structure and support systems. Second, Aerospace Ground Equipment (AGE) provides powered and non-powered AGE to support the missions. Third, the Aerospace Systems branch maintains aircraft systems including fuel, pneudraulic, environmental, and repair/reclamation activities. Fourth, Propulsion branches/section provide on- and off-equipment maintenance for propulsion units, propulsion components, and propellers. Finally, in certain special mission units, munitions maintenance and support activities are also assigned to FMS. (12:22-31).

Organizational Maintenance. The Organizational Maintenance Squadron (OMS) provides primarily on-equipment maintenance for assigned and transit aircraft. Off-equipment maintenance is limited to the capability of personnel and equipment primarily in the support branch. The major on-equipment functional responsibilities include servicing, scheduled and unscheduled maintenance, pre-flights, post flights, thru flights, and home station checks. To accomplish these tasks the OMS is organized into a transient branch, flightline branch, inspection branch, and support equipment branch. These functions are performed by aircraft general maintenance personnel. (12:16-21)

DCM Staff. Having briefly described the organizational elements which provide the manpower and equipment to support the MAC maintenance mission, the focus now shifts to the DCM staff. The DCM staff is organized to perform a variety of functions: maintenance control, quality control, and administration. Maintenance control, with its centralized emphasis on production control and direction, is the dominant area for this discussion.

> Maintenance control is the staff function responsible for directing the maintenance production activities, authorizing the expenditure of resources, and controlling the actions required to support the mission. Maintenance control manages the full cycle of production by planning, scheduling, directing, and controlling all maintenance on primary missions, mission support, and transient aircraft, including related support and training equipment. To accomplish their responsibilities, maintenance control is divided into three functional elements: job control, plans and scheduling and documentation and materiel control. (11:12)

Job Control. Job Control directs and controls the expenditure of maintenance resources. Through job control all actions taken to maintain and/or return aircraft to serviceable condition are directed. Maintenance plans are constantly monitored to ensure maintenance is completed according to established priorities. When unscheduled maintenance is required, Job Control directs the personnel and equipment resources of the maintenance squadrons to perform the necessary repair. Job Control also coordinates materiel requirements through Materiel Control and Plans and Scheduling to ensure parts are available when and where needed. Job Control is the hub of the on-equipment maintenance effort. To ensure that both scheduled and unscheduled maintenance supports the wing mission, job control coordinates with Plans and Scheduling and Documentation. (11:12-13)

Plans and Scheduling and Documentation. This function integrates operational mission requirements with scheduled and unscheduled maintenance requirements to support the overall mission within the constraints of maintenance capability. Through the use of quarterly, monthly, weekly, and daily maintenance planning cycles, Plans and Scheduling ensures support to the mission where capability exists and works to resolve shortfalls to meet requirements when necessary. The documentation section maintains the historical records for assigned weapon systems, training devices, and support equipment. Accurate records ensure that scheduled inspection/maintenance, modification, and time change requirements are accomplished at the proper interval. (11:18-41)

Materiel Control. Materiel Control provides coordination between maintenance and supply, manages supply transactions for the maintenance complex, and manages the production of assets in the repair cycle. (11:50) The maintenance supply liaison (MSL) section interfaces with both the maintenance organization and the central base supply system and assists maintenance personnel in solving supply related problems. The production control section directs and controls the off-equipment maintenance effort to return line replaceable units (LRU), components like black boxes, and shop replaceable units (SRU), sub assemblies of LRUs, to the supply system. This effort is controlled by shop scheduling and the Repairable Asset Control Center (RACC) which acts as an off-equipment job control and parts processing function. (11:--)

In summary MAC maintenance organization structure follows the classical design top down pyramid form. The key elements in this system are Maintenance Control which provides centralized control over the entire system, and the maintenance squadrons which execute the maintenance necessary to support the operational mission.

Advantages/Disadvantages

Positive. MAC's centralized maintenance concept has several positive aspects when analyzed on a classical theory basis. First, operating from stable and secure bases in the continental United States (CONUS), a stable organizational environment allows the centralized system to provide a high level of self-sufficiency. Second, specialization provides a high level of expertise for organizational and intermediate level maintenance. Third, economies of scale can be achieved through the division of labor. Further, centralized control can focus the direction of the total maintenance effort to meet specific objectives.

Negative. Critics of classical theory would point out potential weaknesses, however. They would point to the red tape, inflexibility, dominating authority, and position protection as negatives. (6:291) When compared to historical experience, the centralized system appears to be most vulnerable in overseas locations where rapid redeployment and reconstitution may be required. Fixed intermediate level shops, if not hardened would be a vulnerable high priority target. Strict specialization also hampers flexibility when personnel attrition is considered. The TAF and SAC have taken the decentralized approach to counter these problems.

CHAPTER 4

DECENTRALIZED MAINTENANCE

Tactical Air Forces (TAF)

Combat Oriented Maintenance Organization (COMO)

The TAF, comprised of Alaskan Air Command (AAC), Air Force Reserve (AFRES) tactical units, Pacific Air Forces (PACAF), Tactical Air Command (TAC), and United States Air Forces Europe (USAFE), utilize the decentralized system called Combat Oriented Maintenance Organization (COMO). AAC/AFRES/PACAF/TAC/USAFE Regulation 66-5, Combat Oriented Maintenance Organization, Part One, Policy and General Responsibilities states the objectives of the decentralized system are mobility and flexibility. This organization structure evolved from the TAC experience in developing the Production Oriented Maintenance Organization (POMO) concept in the mid-1970s.

Squadrons. TAF maintenance organizations using COMO are structured with three squadrons performing the direct production functions under the Deputy Commander for Maintenance (DCM). These squadrons are the Aircraft Generation Squadron (AGS), Component Repair Squadron (CRS), and Equipment Maintenance Squadron (EMS). A description of each follows. (16:1-6)

AGS. The Aircraft Generation Squadron (AGS) is primarily responsible for on-equipment maintenance. These squadrons are organized and staffed to maximize sortie production capability in minimum time. The major element of the squadron is the aircraft maintenance unit (AMU) which has near autonomy in its ability to perform all the major maintenance functions on primary mission aircraft. The AMU has crew chiefs, specialists, and weapons load crews assigned. These personnel are normally organized into flights; however, unit size, weapon system, or theater unique conditions may dictate separation of specialist and weapons branches. The most significant difference between AGS and its traditional maintenance counterpart OMS (centralized maintenance) is that both authority and responsibility for meeting missions requirements rests with AMU management on a routine basis as opposed to job control. (16:9-1)

CRS/EMS. The sources of off-equipment maintenance capability are the Component Repair Squadron (CRS) and Equipment Maintenance Squadron (EMS). First, CRS provides off-equipment capabilities not possessed by the other squadrons and on-equipment when warranted and coordinated through the Maintenance Operation

Center (MOC). The organization structure consists of the following branches: accessory maintenance, propulsion, conventional avionics, integrated avionics, aircrew training devices (ATD), and test measurement and diagnostic equipment branch. Within the branch specific shops grouped by specialty ensure that training is accomplished to support maintenance production. In the CRS the control over the repair cycle is at the shop chief level. To support the overall maintenance effort and increase weapon system familiarity, specialists from the CRS can be dispatched by the MOC to support periodic maintenance such as isochronal, phase, or periodic inspections performed by EMS.

The Equipment Maintenance Squadron (EMS) performs both on-equipment and off-equipment maintenance through its five branches. The flightline support equipment (FLSE) branch inspects, services, repairs and dispatches both powered and non-powered support equipment. The maintenance branch maintains and performs scheduled inspections on aircraft and equipment. The fabrication branch does repair, maintenance, modification, local manufacture, and inspection on aircraft and equipment. (16:20-3) The munitions branch maintains conventional, nuclear, and chemical weapons and their associated suspension and release systems. This branch is also responsible for the storage and inspection of all munitions. The explosive ordinance disposal (EOD) branch (as the name implies) has the unique responsibility of being trained and equipped to disarm or dispose of hazardous munitions. The internal control of production, training of personnel and expenditures of maintenance resources is delegated to the lowest practical level. As with CRS, EMS capability may be dispatched through coordination with the Maintenance Operations Center when necessary.

Staff. The DCM staff performs many of the functions familiar to the centralized maintenance organization. The key difference falls in the organizational element directly involved in the production process: the Maintenance Operations Division. This staff function corresponds to Maintenance Control in the centralized organization; however, the amount of control exercised by the staff is significantly reduced. The elements of the Maintenance Operations Division are the Maintenance Operations Center, Maintenance Plans, and Materiel Control.

Maintenance Operations Center (MOC). The Maintenance Operations Center holds the central functional responsibility for directing or monitoring sortie production to meet the flying schedule and maintenance production. The major contrast with the centralized system's job control lies in the degree to which control is exercised. Off-equipment production is controlled by EMS and CRS. On-equipment maintenance, within the capability of AGS personnel and facilities, is controlled by AGS supervision. MOC personnel monitor production to ensure that overall maintenance objectives are being met.

This includes setting priorities for joint use facilities and equipment and redirecting maintenance effort when necessary. Positive direction is assumed by the MOC under emergency/contingency operations. (16:3-2)

<u>Maintenance Plans</u>. Maintenance Plans has two branches: Plans, Scheduling, and Documentation and Combat Plans and Mobility. Plans, Scheduling, and Documentation, like its centralized system counterpart, integrates maintenance capability to support aircraft sortie production and training. The monthly, weekly, and daily planning cycles enable optimum use of maintenance resources. A cooperative effort between squadron supervisors and Plans and Scheduling keep the daily schedule current. The AMU chiefs, production superintendents,or flight chiefs incorporate maintenance needs generated during the day into the daily maintenance plan. (16:3-16) The documentation function has the same basic responsibility as in the centralized system; however, the DCM may decentralize some documents down to the shops responsible for the equipment. The central documentation function is still responsible for document reviews. Documentation also assists Plans and Scheduling with time phased inspections and depot level maintenance planning. Additionally, Documentation aids Materiel Control in time change item management.

The Combat Plans and Mobility function of the Maintenance Operations Division acts as the focal point for deployment/employment, contingency, and operational readiness inspection planning for the maintenance complex. (16:3-43) Combat Plans and Mobility reviews existing plans and develops maintenance plans to support operational plans. This includes aircraft generation and munitions support plans for contingency operations. Also, checklists are developed and training conducted to ensure personnel are prepared in all phases of mobility.

<u>Materiel Control</u>. Materiel Control coordinates between maintenance and supply, manages supply transactions for maintenance, and monitors the production of repairable assets. The two functions of Materiel Control which accomplish these tasks are Maintenance Supply Liaison (MSL) and Repair Cycle Monitor (RCM). Again, the primary contrast between centralized and COMO organizations lies in the production arena. The RCM, as the name implies, monitors off-equipment production, but the control of the production is the shop supervisor's responsibility.

<u>Advantages/Disadvantages</u>

<u>Positive</u>. COMO has demonstrated significant improvements over previous attempts at decentralization. Using the Aircraft Maintenance Unit (AMU) concept aligned with deployable flying squadrons, the mobility of tasked units is greatly improved without violating the unity of command principle which occurred with the Squadron Maintenance concept in Vietnam. Behavioral advocates would contend that the decentralized system provides a

better environment for developing leadership in subordinates by placing the responsibility for decision making at the operating level. This gives individuals more experience in exercising individual initiative and judgment. Further, using specialists to perform a variety of tasks outside their primary utilization field adds flexibility and responsiveness. The on-equipment focus of the AGS/AMU makes the unit more deployable and less dependent on fixed intermediate assets; however, potential problems still exist.

Negative. Until follow-on intermediate support arrives, host base assets will be severely taxed. Additionally, units deployed or dispersed without intermediate level support will require significant stocks of line replaceable units (LRU) to maintain sufficient sortie rates. Ineffective coordination and concentration of effort associated with previous decentralized systems may still be a problem; however, the Maintenance Operations Center (MOC) can assume centralized control if necessary to focus effort where needed most. Now lets look at the new SAC decentralized system.

Strategic Air Command (SAC)

Readiness Oriented Logistics System (ROLS)

Strategic Air Command (SAC), long the stalwart of AFM 66-1 centralized maintenance, has adopted a flexible system, called the Readiness Oriented Logistics System (ROLS). This system incorporates many of the features found in the POMO/COMO systems which emphasize decentralization. SAC Regulation 66-14, Readiness Oriented Logistics System, Vol 1, specifies that this organization makes possible a clear line of authority and accountability from the DCM [Deputy Commander for Maintenance] down to the lowest echelons of aircraft maintenance. (14:1-1)

Squadrons. The major production organizational elements are retained from the traditional 66-1 centralized system. They include four maintenance squadrons: Organizational Maintenance Squadron (OMS), Avionics Maintenance Squadron, (AMS), Field Maintenance Squadron (FMS), and Munitions Maintenance Squadron (MMS) and the DCM staff. The two major changes are the shift of specialists into organizational maintenance and the shift of production control to the production squadrons. (18:2)

OMS. The Organizational Maintenance Squadron gains a specialist branch by moving personnel from AMS and FMS. (18:3-4) These specialists are now assigned to on-equipment responsibilities. They perform the trouble-shooting, remove and replace action, and servicing necessary to return aircraft to operational status.

Since the specialists are now located on the flightline and readily available to direct their attention to weapon system generation, the time needed to regenerate aircraft should be reduced. Responsibility and control of personnel and equipment resources necessary for on-equipment maintenance has now shifted to OMS maintenance supervision. This shift places control in the hands of maintenance officers and senior NCOs closest to the action. Where specialist are not directly assigned to OMS due to organizational size and/or personnel availability, they can be requested by OMS supervision through the Aircraft Readiness Center. (15:2-7)

AMS. Avionics loses some of its specialists to OMS for the on-equipment maintenance function. However, AMS retains specialist for off-equipment and such on-equipment maintenance which exceeds the capability of OMS. Responsibility and control of production now rests with AMS supervision down through the branch and shop level. The specific organization structure is dependent upon missions systems, organization size, personnel, and such.

FMS. FMS, like AMS, loses on-equipment maintenance personnel to OMS. Similarly, FMS supervision assumes a much greater role in the production of off-equipment maintenance.

MMS. MMS, due to its highly specialized nature, remains essentially the same structurally as before. More production responsibility is delegated to the unit level.

DCM Staff. Under the ROLS concept, major changes to the structure and roles of the DCM staff were made. First, there are now two major subordinates under the DCM, Assistant DCM (ADCM) and the Assistant DCM for production (ADCMP). The ADCM oversees administration and standardization of training. The ADCMP directs maintenance control which includes: Programs and Mobility, Production Analysis, Aircraft Readiness Center (previously Job Control), Plans and Documentation, and Material Control which may be aligned under OMS or FMS supervision at the DCM's option. (1:12-11)

Aircraft Readiness Center (ARC). The role of the Aircraft Readiness Center (ARC) is now one of monitoring and tracking rather than control. The ARC also sets priorities for facility and equipment use when two or more of the maintenance squadrons are involved. Under continuing/emergency situations, the ARC provides positive guidance as required. (14:3-5)

Material Control. The Material Control functions may be assigned to OMS if desired. This function has diminished significantly from the AFM 66-1 system. The Maintenance Supply Liaison function once under the DCM is now transferred to the Chief of Supply. In its place Bomber/Tanker Support Sections (B/TSS) provide dedicated support to the SAC maintenance mission. A significant change has been to move parts as close as possible to the maintenance by establishing Aircraft/Repair Shop Parts Stores. Moving supplies closer to the point of use reduces the lag time experienced in the centralized system. (14:5-1)

Other Staff. The other functional areas of the DCM Staff perform essentially the same as in the centralized systems. Where unit size, mission, and geography dictate ROLS provides the flexibility to move functions such as documentation to the maintenance squadrons.

Advantages/Disadvantages

Positive. Though there is limited experience with SAC's new system, ROLS appears to have the structural advantages espoused by those in favor of a compromise between classical design theory and the behavioral approach. First, decision making has been pushed down to lower levels, promoting leadership development. Second, the basic structure of production units retains the inherent advantages of specialization in off-equipment maintenance. Third, on-equipment maintenance added the responsiveness and flexibility not available previously by assigning specialists to the OMS. SAC provided additional flexibility to this system by giving the DCM greater latitude in matching the organizational structure to the local environment.

Negative. Due to the short time ROLS has been in effect, an objective evaluation of problems would be premature. However, potential resistance to change is present with any organizational change of the magnitude SAC has undertaken. Establishing effective training programs to broaden specialist skills, ensuring both on-equipment and off-equipment maintenance support are balanced, and providing support to deployed units are but three of the challenges.

CHAPTER FIVE

CONCLUSION/RECOMMENDATIONS

Conclusions

The current maintenance organization structures do support the Air Force logistics concept of operations. While all are basically beaureaucratic in form, the impact of behavioral factors is evident in the trend toward greater flexibility. Further, while not addressed directly in this study, leadership is far from a minor factor in affecting responsiveness. With the proper resources and leadership a balance can be struck on the spectrum between centralization and decentralization.

Centralization/Decentralization. The role of centralization/decentralization in developing maintenance organization design is not clearly at one end of the spectrum or the other. Management theorists still debate the benefits of the classical design theory and the behavioral approach. History shows us that aspects of each system are beneficial depending on the environment and objectives. When selecting an organizational design, leaders and planners need to evaluate the potential impact of changes not just on short run, narrowly defined objectives, but on the logistics system as a whole.

Impacts. Organizational design philosophy as illustrated by the maintenance organizations described in this report have a direct impact on the way each system operates. Of greater significance is the effect organizational design can have when it comes to supporting the logistics concept of operations.

MAC. The centralized system promotes specialization, division of labor, narrow expertise, and rigid control. These aspects accrue economies of scale and efficiency; however, the inflexibility, red tape, and vulnerability overseas could be serious detractors. MAC plays a key role in both intertheater and intratheater transportation. In supporting this role maintenance organizations need the flexibility to use personnel and resources across functional lines to rapidly turn aircraft in the hostile environment of combat. Procedures that speed repair action and delivery of spare parts to the flightline are essential. Maintenance resources must be hardened to ensure survivability. Intermediate level maintenance capability built into the centralized maintenance concept enhances the logistics concept of self-sufficiency.

TAF. After several attempts at trying to match a maintenance organization structure to the mobility and sortie generation roles, Tactical Air Forces have adopted COMO. The system has shown positive gains for over ten years; however, a long logistical supply trail may accompany the rapid deployment capability. Intermediate level maintenance capability may not be readily available to sustain continued sortie generation after initial spares are consumed. Prepositioned resources in hardened facilities can overcome this constraint. But, the cost is high.

SAC. The switch from centralized to decentralized maintenance system is a major change in the way SAC performs maintenance. Initial indications are positive, but sufficient data is not available to make concrete conclusions at this time.

Recommendations

The following recommendations are simple, straightforward, and general. The problem of evaluating the impact of subtle changes to specific organizations on the whole logistics system still remains a major challenge. The real test will come in combat when finding deficiencies could have an unacceptably high price. In the meantime, a concerted effort should be made to identify and resolve shortcomings as time and funding permit.

Exercises. Major commands and joint agencies should develop exercise scenarios which maximize the strain on the logistics system inherent in combat operations. These exercises should include attrition of personnel, facilities, lines of communication, and transportation assets. Realism is the key.

Simulation. Simulation models should be developed to try alternative methods under constraints which cannot be exercised. Models which provide realistic worst case situations should be employed. Inputs and constraints should be derived by experienced front line personnel from each logistics discipline. The task would be hard but the alternative could be worse.

Follow-on Research. This paper has only scratched the surface of one aspect of the logistics system required to meet the demands of future combat. The Air Staff should sponsor an integrated research project using Air Command and Staff College, Air War College, and Air Force Institute of Technology resources to study the interface between logistics functions at the wing level. The resources of maintenance, supply, and transportation must be organized in such a manner that they compliment each other in supporting the operational mission.

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